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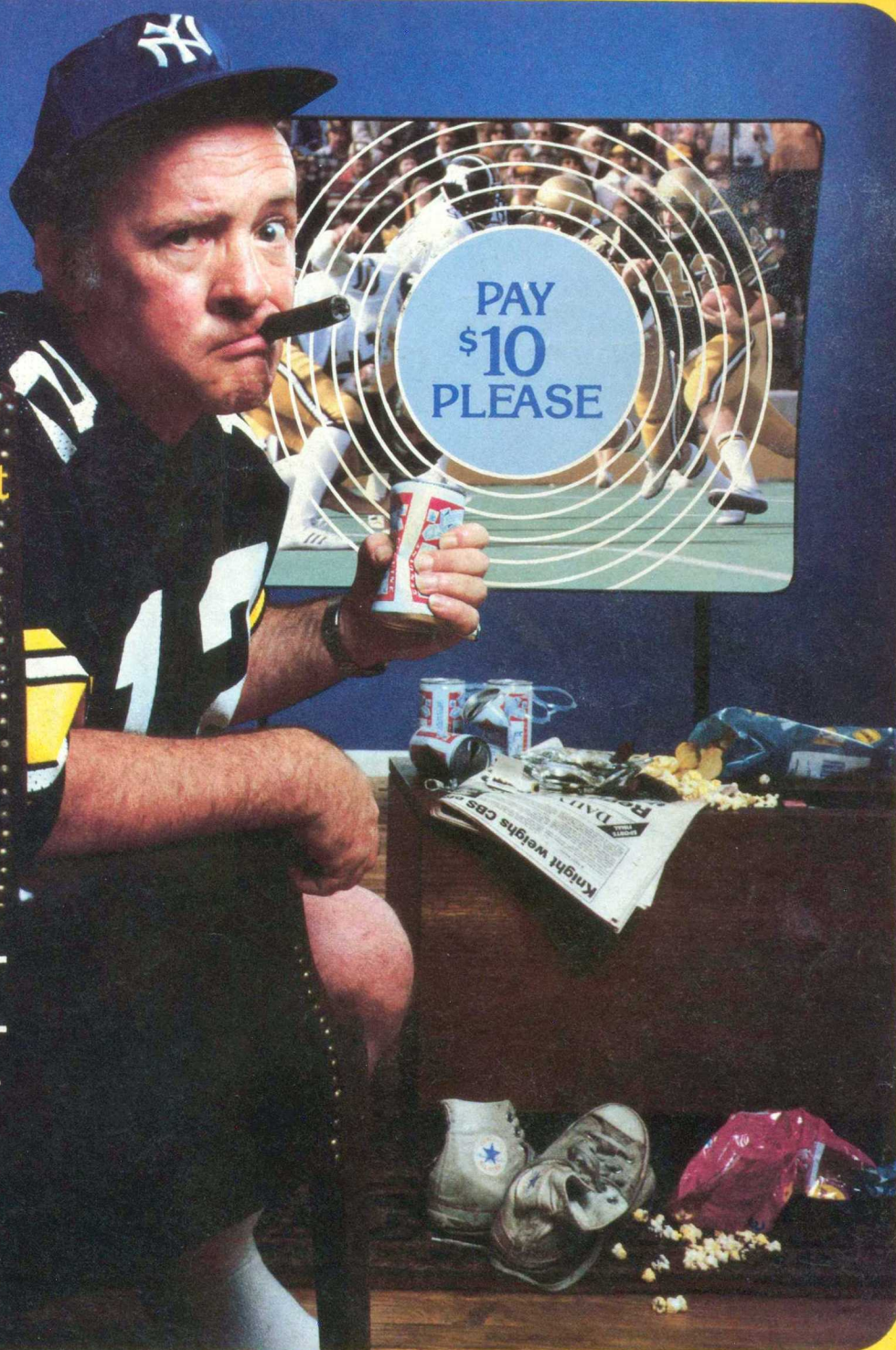
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Videodisc Format
Explained

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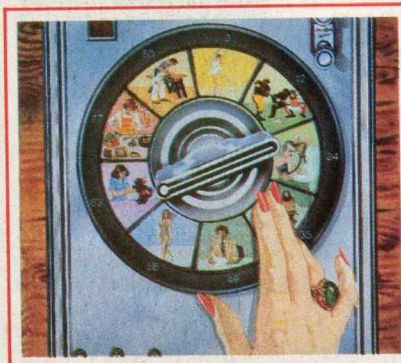
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ABOUT THE COVER

Traditionally, the only price sports fans have had to pay for catching their favorite events on TV is sitting through the commercials. But cable and pay-TV are changing all that by bringing home an expanded range of video sports—and making the viewer foot the bill. Cover photo by Les Morsillo.



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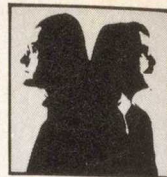
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Arcade Alley

A Critical Look at Video Cartridge Games & Programs

by Bill Kunkel & Frank Laney, Jr.



A Sports Trio from Mattel

Don't worry about that strange light shining over "Arcade Alley" this month. It's perfectly safe. It's just the rosy glow of parental pride. The team of Laney and Kunkel have become, respectively, the co-publisher/editor and executive editor of a brand-new publication called *Electronic Games*.

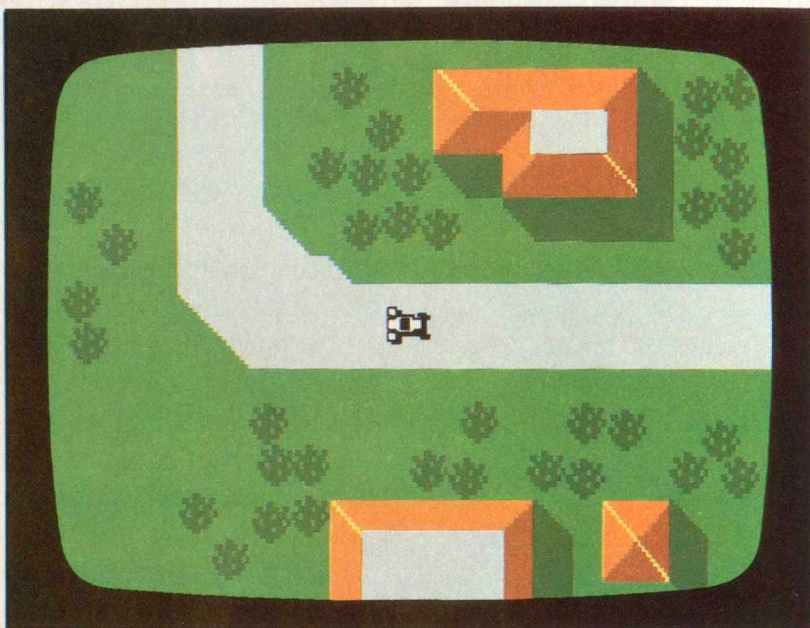
For arcade addicts like us, this is truly a dream come true. For the first time, there's a whole magazine exclusively devoted to the fast-growing hobby of electronic gaming. Our premiere issue is jammed with news, reviews, and features about this high-tech pastime that you won't find anywhere else. So if you like video games, commercial arcades, hand-held games, electronic stand-alones, and computer simulations, this magazine definitely belongs on your "must read" list. The first color-packed issue of *Electronic Games* is already available at your favorite newsstand. (If they don't have it, perhaps it's time you picked a new favorite, eh?) Don't risk hearing "all sold out!" from the newsstand vendor; get your copy before they're all gone.

"Arcade Alley" hasn't dedicated a complete column to Mattel's Intellivision system in quite some time. We'll redress that oversight this time with three recent releases that are likely to prove especially interesting to sports-minded arcaders.

Auto Racing (1113) is undeniably the best video game any manufacturer has produced about this subject so far. Even jaded arcaders who automatically turn up their noses at the mere sight of the typical race game may find this boldly innovative approach much more to their liking.

The most obvious point of difference separating Mattel's "Auto Racing" from the rest of the pack is its graphics. Not only are the five race cars—colored white, green, red, tan, and blue—rendered realistically, but so are both the track itself and surrounding scenery. The on-screen artwork is similar to what Mattel's designers used for "Armor Battle," which means that "Auto Racing" is one of the best-looking game cartridges available.

Greatly enhancing both the looks and play of the game is the unusual presentation of the playfield. Instead of showing a static overview of an entire course, the screen scrolls so that only a small stretch of the track is visible at any time. This has



On-screen graphics help make 'Auto Racing' the best video game produced in this genre.

two benefits: it increases the effective size of the playfield and it prevents drivers from planning their route too far in advance. The latter gives "Auto Racing" a much more realistic feel, since drivers must constantly make split-second decisions.

Unfortunately, this arrangement also has one disadvantage. If one car takes a lead of more than 12 lengths over the second-place vehicle, it becomes impossible to show them on the screen simultaneously. In the two-player version of "Auto Racing," the computer automatically stops the action when this occurs, awards two points to the leader, and restarts both racers at the most recently passed checkpoint. There is of course no similar problem when one arcader is driving solo in a five-lap race against the clock. For that reason many will prefer to do most of their racing against the timer rather than head-to-head.

"Auto Racing" offers a choice of five tracks of progressively greater difficulty. Number one is essentially a speed circuit that is ideal for the less experienced, but even electronic Foyts and Anderettis will

have fits negotiating the final hairpin turn on the fifth course. The game's five cars offer four different combinations of top speed, acceleration, and cornering ability. (The tan and blue cars are identical, for use when two equally skillful drivers are competing.) For example, the white car can achieve a top speed of 55 mph, but the tan and blue autos can whizz along at 90 mph.

Steering is sensitive but takes a little practice. Depressing a section of the direction disk's circumference toward the appropriate edge of the playfield sends the car in that direction. That is, the player presses the "12:00" point on the disk to send the auto due north. Drivers can make sharp or gradual turns but risk spinning out of control if they try to change direction too abruptly. Once set in motion, cars accelerate constantly. Drivers can break by pressing one of the buttons located on the side of the hand controller, and the racers slow if they wander onto the grass or into the water. The computer also exacts a time penalty after every crash.

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Video Sound

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RCA CED players. Blackmer says the discs would be compatible with all CED equipment.

Whether RCA adopts Blackmer's system or some other one or none at all, one thing is certain: the future of video will be in audio. The long-heralded synthesis of audio and video may finally be at hand.

Video Noise-Reduction Systems

Whether embedded in vinyl or transmitted over the air, most audio information is compressed. That is, low-level sound is increased and high-level sound is decreased, thus reducing the difference between the loudest and softest passages along with aural impact. As low-level sound is increased, inherent noise is increased with it, compounding a possibly inefficient signal-to-noise ratio.

Most noise-reduction systems work on a compression/expansion principle. As material is compressed, weak signals (and noise along with them) are increased. The process is reciprocal: on playback, when weak signals are reduced, the noise level—lower than the signal—is reduced more than the signal. The strong signals are compressed on recording (or encoding, as it is called) and increased on playback. In essence, the weak signals decrease and the strong signals increase, yielding a wider dynamic range and lower

residual noise. Dolby circuits operate in this way, as do dbx and CX. Dolby B gives an increase in noise reduction of 10 dB above about 7000 Hz. Dolby C provides 20 dB of noise reduction over a wider range than the B circuit.

Dbx is a linear compression/expansion system. It operates over the full frequency spectrum and yields about 30 dB improvement in S/N over the entire band at the mid-frequencies. Whereas Dolby C produces 20 dB of noise reduction, dbx yields better than 40 dB. However, both dbx- and Dolby-encoded signals must be decoded to sound acceptable.

CBS's CX system is said to be compatible. That is, it is a compression/expansion system gentle enough to sound acceptable when not decoded, and very good when decoded. CX compresses only loud signals and expands them in decoded playback. On playback, the loud passages become louder and the listener can turn down the volume, thus making the soft passages softer while restoring the original dynamic balance. An undecoded disc sounds somewhat compressed, but not as substantially as one might think. Looked at another way, it gives you a good idea of how much compression goes on ordinarily. The CX system that record companies are looking at provides a 20-dB increase in noise reduction. The variants currently tested by Pioneer are said to produce about 15 dB.

The DNR is an after-the-fact device which requires no encoding and produces about 14 dB of noise reduction. Advanced Audio Systems sells it for use with LV disc players. It senses the masking ability (the ability of a program to hide background noise) and then varies the passed bandwidth accordingly. —M.P.

trees are the major obstacles facing skiers in this game. Players can glide around them with a few fancy turns or, in the case of moguls, leap over them to safety by pushing a lower-side button at the proper instant. When challenging the downhill course, gamers should avoid any movement that cuts speed. This means that each gate should be approached on a straight line, not reached by a series of short turns. The slalom, on the other hand, is a different kettle of fish. Here finesse carries the day nearly every time. Be prepared to steer back up the hill for short stretches; it's practically a necessity for the second gate, for instance.

While there's nothing breathtakingly new about Mattel "Skiing," it packs an amazing amount of detail into an easy-to-learn contest. It's equally entertaining as a solitaire game or as a three-heat tournament.

PGA Golf (1816) offers one or two duffers the opportunity to test their mettle on a nine-hole par-38 course. This cartridge stresses the putting phase of the sport a bit less than other video golf games, opting instead for a much more detailed presentation of the role of club selection.

In contrast to other golf cartridges you may have tried, it makes a considerable difference in PGA Golf whether you choose a #3 wood or a #5 iron for a particular shot. Easy-reference charts in the instruction book provide average carrying distances for long, medium, and short swings using each of the nine available clubs as a guide for arcaders who might be unfamiliar with real-life golf. While some clubs—the driver, wedge, and putter—are used only in specific situations (all explained in the rules, of course), the other six must be used at the proper time to keep scores from ballooning embarrassingly.

Although arcaders determine the general direction in which the ball is to be hit by manipulating the direction disk, the mechanics of the actual swing are handled separately. The screen displays a close-up of the golfer in the upper left-hand corner of the playfield to make this easier. The gamer presses a side button to initiate the swing and then pushes it again at the proper point during the club's arc toward the ball to produce the desired slice, hook, or straight shot.

Terrain also has a greater effect on play than in some other golf games. The ball's trajectory must be calculated when selecting a club, or tree branches may get in the way and deflect the ball. Mattel has thoughtfully furnished a chart indicating the probable path of a shot's hit with each of the available clubs.

"PGA Golf" may take a little longer than the average video game to master precisely because it includes so many novel features. Yet it is these very features that are sure to make it one of the most frequently played cartridges in any Intellivision owner's game library.

Arcade Alley

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Skiing (1817) gives gamers a taste of what it's like to roar down a snowy slope, minus broken limbs and wind-burn. Up to six hotdiggers can compete in either the downhill or slalom. This cartridge furnishes an acceptable range of variations, although there is only one basic trail for each event. Choosing the specific race is a four-step process:

(1) Select game speed. There are four choices ranging from exceptionally slow to normal.

(2) Indicate the number of players. One to six can participate and the computer keeps track of who does what throughout the game.

(3) Pick the degree of slope. This runs from one (gentle) to 15 (steep). The

steeper the slope, the faster the speed of descent. Of course greater velocity also increases the chance of a skier careening out of control, so beginners should start with slope number four.

(4) Choose the type of race. The downhill is a speed event, while the slalom challenges players' ability to maneuver at high speeds.

Steering is fairly straightforward, a necessity in a game that depends on lightning reversals of direction. Skiers turn in a circular motion. Pushing the left edge of the direction disk sends them clockwise while pushing the right side moves them counterclockwise. On-screen skiers slow when they are heading up the slope or are perpendicular to it and gain speed when the skis point toward the bottom of the hill. Sharp turns are accomplished by pushing both the direction disk and one of the side buttons at the same time.

Moguls, outcroppings in the snow, and

\$1000... Under \$500

\$1000... \$900... \$800... What you can and can't

\$1000... \$900... \$800...

by Tim Onosko

Since their introduction in 1975, microcomputers have created a new industry. These powerful but small machines are a big hit, bringing computing into small businesses, classrooms, and homes.

Despite their popularity, though, microcomputer systems have been beyond the budgets of most home users. The reason? While the computer units—the keyboard/processor components—are priced in the \$900-to-\$1800 range, expensive add-ons like floppy-disk storage units and printers boost the price into the thousands of dollars.

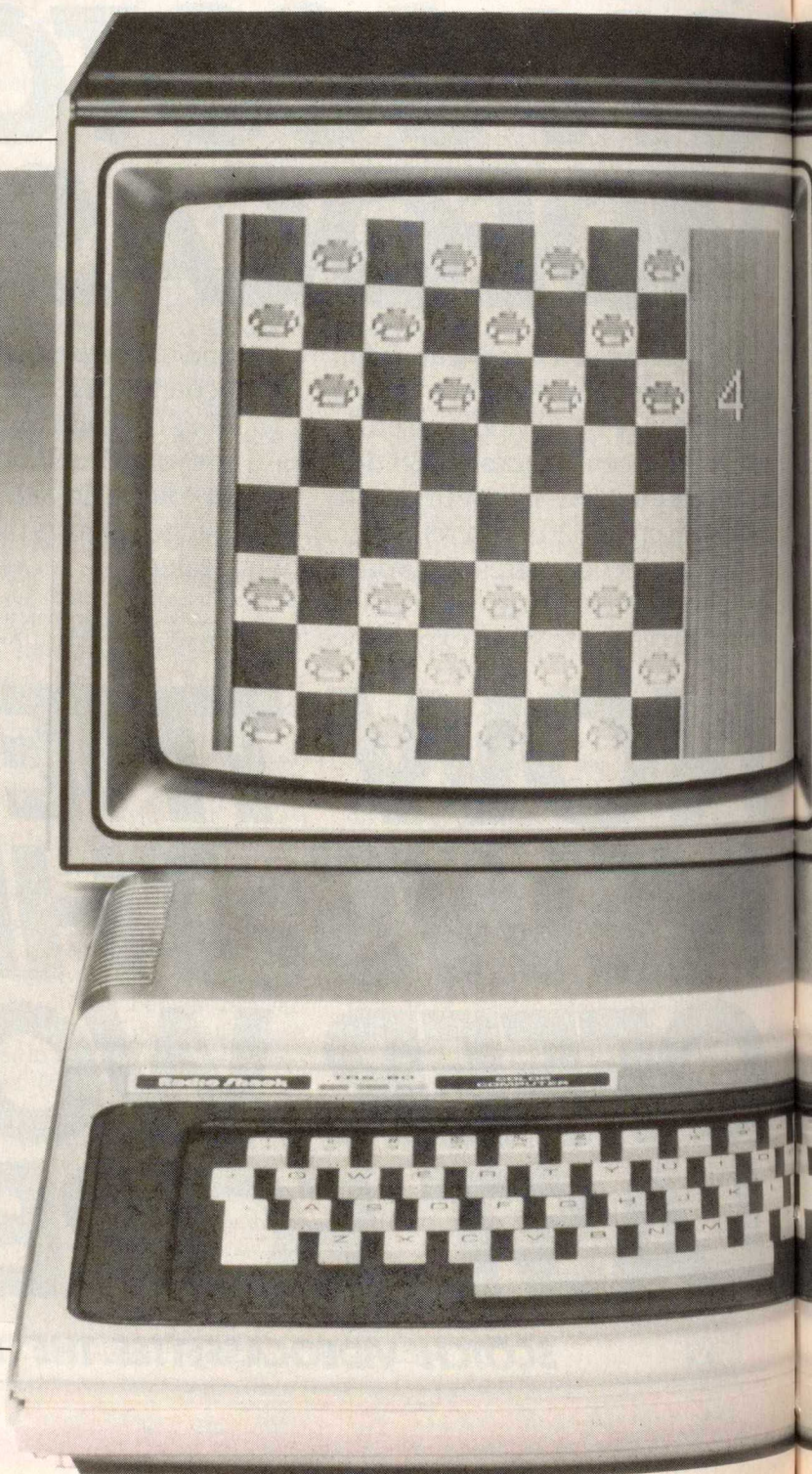
Enter the under-\$500 home computer, designed to be attached to your TV. The four new machines aimed at home users are Commodore's VIC-20, Radio Shack's TRS-80 Color Computer, Atari's 400, and Sinclair's ZX-80.

First, a few words of caution about buying cheap home computers. Though newer, cheaper computers are becoming available, many people may still haunt bargain basements—not a wise move. Computers like the Videobrain and Interact, both offered by mail-order surplus or liquidation dealers, are available at rock-bottom prices—but both are also early casualties of a highly competitive industry and are no longer being manufactured. To buy one is to invest in a white elephant: the machine may be useful for some applications, but information about them and programs for them may be difficult to unearth.

Reputable mail-order companies also offer discount prices on the new home computers. But computers can be complicated, and first-time owners will have many questions that a mail-order dealer

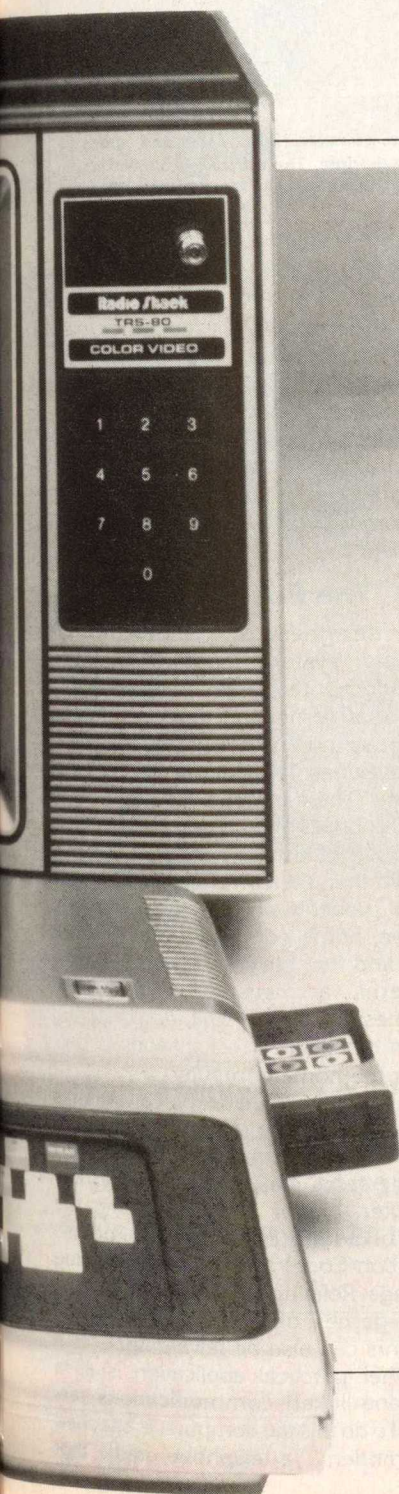
Tim Onosko is a contributing editor of this magazine.

Radio Shack's TRS-80 Color Computer is the latest in a series that began with its original TRS-80. It comes with 4K of memory and limited BASIC for \$399 and can be upgraded to 32K and more advanced BASIC for \$600. The widely spaced keyboard is a bane to touch-typists.



Computers

do with microcomputers



Atari's price drops have brought its 400 computer down to \$399. Its two main drawbacks are its compulsory 16K memory and flat keyboard. The 400's graphics are superlative—Atari is a leading video-game maker. Accessories come in various customized packages.

cannot or will not answer. Buying a computer from a computer store and finding a computer "user group" in your area is the best route for a neophyte to take.

Remember: saving a few dollars when you buy may mean spending more hours learning to use your computer.

The Limitations

A computer is of little use without programs to run on it. While even the least-expensive computers are powerful, two factors limit what you can do with them.

One is the way programs are stored. Many larger, more expensive microcomputer systems use "floppy disks" to store programs written by users. Cheaper systems tend to rely on tape-cassette systems, for the most part standard audio-cassette recorders. Disk has two advantages over tape: loading a program into the machine is much faster, and disks can be randomly accessed for loading a particular program or block of data. (For a computer to find the third program on a tape cassette, it must first play through the first two.)

Floppy-disk drives are needed for complicated computing chores, but are expensive. All the new home computers except the Sinclair also use another method to load programs: they accept program "cartridges," similar to the familiar video-game cartridges. Like home games, cartridges designed for one computer cannot be used by another. Such read only memory (ROM) cartridges load programs instantly, even faster than disk drives, but can't store programs and data that you create. ROM cartridges are

for commercially available programs.

The second limitation all computers are subject to is memory size. Computer memory is measured in "bytes," each roughly equivalent to a character (a letter or number). The more memory a machine has, the more capable it is of doing complex tasks. More memory means longer, better programs can be run. More memory, in some machines, also means more intricate or colorful graphic displays can be drawn. The memory size of a computer is stated in

thousand-byte units, each called a "k" for "kilobyte." So an 8K computer is bigger than a 4K computer. These sizes normally can go all the way up to 64K. That a home computer is sold as a machine with small memory doesn't necessarily mean you're stuck with that amount. Almost all can be upgraded, though some are easier to upgrade than others, and the new, inexpensive computers have limited expansion capability.

The Possibilities

The designers of the new home-computer systems assume that the home-computer owner will probably confine his computing to the TV screen and not spend another \$1000 to \$2000 on accessories. This doesn't mean it can't be done. The Atari and the VIC accept both disk drives and printers. Since these components are expensive—usually more so than the computer itself—most owners probably will not invest in them. Even so, home computers can be both useful and fun. Simple home-budgeting programs are available for some machines, and nearly any task requiring tedious repetition of calculations is perfect for the home computer.

One reason to buy a home computer is to learn how to use computers. Though limited, these machines are patterned after the same concepts underlying any computer, big or small. Learning the basics of BASIC (Beginners' All-Purpose Instruction Code) can be an entertaining challenge. Refining programming skills to create games or practical household programs can also be rewarding.

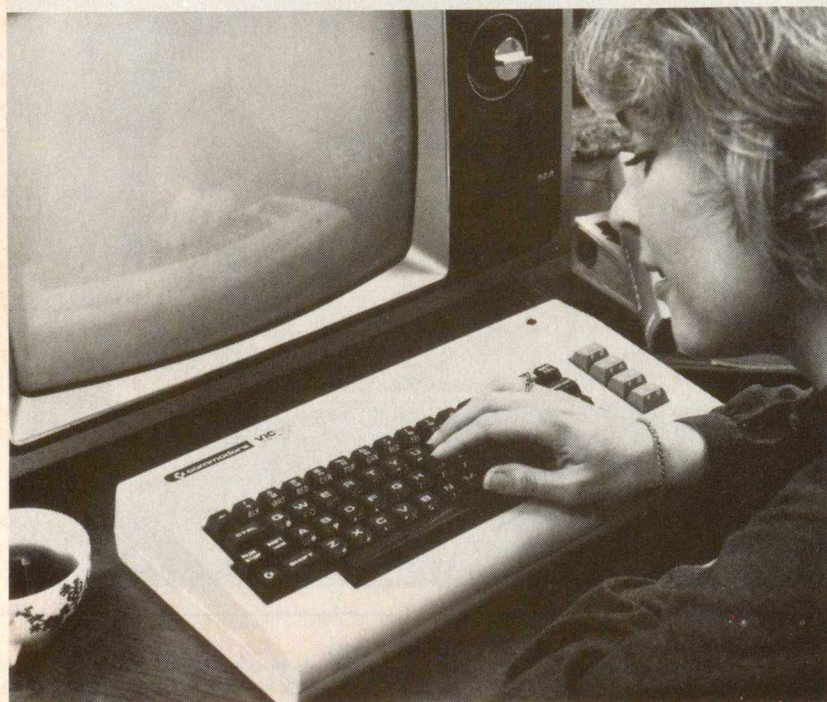
Another practical application is as a telephone-linked communications terminal. To do this the computer is attached to a "modem," a telephone cradle that

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The Sinclair ZX-80, the most diminutive of the bunch, goes for \$200 or less and comes with 1K or 2K of memory, expandable to 16K with a module. The module is needed for more complex computing, though efficient storage stretches the smaller memories.

The Commodore VIC-20, little brother of the Commodore PET, costs \$299 and sports 4K of memory; the Super Expander cartridge brings the potential total to 7K. The VIC's full-sized keyboard is easy to use and possibly the best among lower-priced computers.



Home Computers

continued from page 54

acoustically connects the machine to a host computer. Several computer services are available for home users, including CompuServe and The Source. Both offer information services such as the *New York Times* Consumer Data Bank, UPI news, airline schedules, and game programs in addition to electronic mail services. You can even chat with other computer buffs via keyboard. As the number and quality of videotext services grow, home computers will be an important source of vital information.

The most popular programs for larger and more expensive microcomputer systems are word processors and a program called Visi-Calc. A word processor turns a computer into a sophisticated typewriter. Using your TV screen, you can write, then electronically edit manuscripts, letters, and other documents. Visi-Calc is probably the cleverest microcomputer program. To understand it think of a giant ledger sheet dozens of columns wide by hundreds of rows deep. Each entry on this sheet can be defined as a function of another. If some numbers, for example, are dependent on the cost of fuel, just change that base cost and the rest of the numbers recalculate automatically. While these programs haven't yet been written for most new home computers, their success makes it a sure bet that they will.

Last but not least are the creative aspects of computing. This is where the small home computers excel. Computer graphics and "art" can be endless fun. Some video computers allow you to learn music theory, then compose and play your tunes, even if you've never taken a music lesson in your life.

Games for home computers can be better-looking and more fun to play than any home video game made. Since computer users can create their own games, a kind of game-swapping circuit has developed among owners of more expensive systems, and this is expected to happen for the home computers too. Already new, more complex games are making their computer debut with copies of arcade games either available or promised for the near future.

Games illustrate the need for a good video display, and all are not alike. You may hear computer buffs talk about "hi-res" (for "high-resolution") graphics. Each hi-res screen is made up of thousands of different points; more points make a better picture. Unfortunately, more points also necessitate more memory since a computer graphic (on a home computer) is a visualization of memory. Using hi-res graphics can be tricky and may require advanced programming skills on some machines. Some versions of the BASIC language provide the ability

to easily draw lines, make shapes, and "paint" the screen with color. Others don't. The number of available colors also differs from machine to machine.

There are other ways to make screen graphics aside from the hi-res method. Some computers offer a third set of special characters in addition to upper- and lower-case letters and numbers. These special characters are tiny corners, lines, curves, and other symbols that create boxes, graphs, and pictures when placed next to one another on the screen. This graphics scheme is often referred to as "mosaic" graphics. The crudest form of graphic display is the "block"-graphic screen, on which squares or rectangular blocks make up the picture. While it may

be possible to program a simple "Pong"-style game using block graphics, this method yields the least realistic effects.

The Radio Shack TRS-80 Color Computer

Radio Shack was highly successful with its first computer, the TRS-80 Model One. After that the company introduced several improvements on the original system, making successive models more attractive to business people. The Color Computer, though, is a computer aimed squarely at the hobbyist and first-time user.

The Color Computer, like all home computers, connects to your home TV set. Programs are stored with any stan-

dard cassette recorder. Floppy-disk drives for faster program loading and saving are available but expensive. The first floppy-disk unit costs \$599; successive drives (up to four can be used) are \$399 each.

An "under-\$500" computer, the Color Computer is furnished with 4K of memory and a limited version of the BASIC computer language for \$399. This model can be upgraded with the addition of a more advanced BASIC and up to 32K of memory. Upgraded models are available for \$600 and \$700. You'll soon find 4K is enough for only the simplest programs; 16K of memory is recommended, and Radio Shack's Extended BASIC includes simple commands for drawing on the screen using 192-by-256 point hi-res graphics in eight on-screen colors. (The BASIC supplied with the elementary model isn't capable of doing decimal-point arithmetic, either.)

There are several ways to connect the Color Computer to the outside world. One connecting port is for game paddles and joysticks; another is for ROM program cartridges. The RS-232 port with an industry-standard connector can be connected to a telephone modem for linking into data banks.

Radio Shack likes to promote using the Color Computer as a computer terminal and sells a \$30 program that turns the machine into one. (You'll need one of Radio Shack's modems, priced at \$150 and \$200.) Included in the cost of this package are free one-hour blocks of time on CompuServe and the Dow Jones information retrieval service. But be careful—a second hour on either system can be expensive. Evening rates on CompuServe are \$5/hour (\$22.50 during the day). Dow-Jones costs 75 cents *per minute* at night and slightly more during the day.

Some good programs will probably be written for the Color Computer, since other Radio Shack computers have been well-supported by independent program authors. Word processors and Visi-Calc are promised for 1982, but you'll need a disk drive and printer to use these. ROM cartridges now available include a football game, a space game called "Quasar Commander," checkers, chess, "Bust-up" (a variation of "Breakout"), pinball, a music program, and a home-accounting package. Cartridges are priced from \$30 to \$40.

The biggest mistake made by the designers of this machine is its non-standard keyboard, which has the familiar "QWERTY" typewriter layout but uses widely-spaced keys that are difficult to use for touch-typing.

If you decide to buy a Radio Shack Color Computer, buy from one of the company's Tandy Computer Centers rather than a conventional Radio Shack store. The personnel in the Tandy centers generally know more about their computers and can answer your questions more quickly, and probably more accurately.

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The Commodore VIC-20

The Commodore VIC-20 has much capability but little capacity. Priced at \$299, it comes with only about 4K of memory for program space. This is enough to learn BASIC programming and enough to use Commodore's ROM program cartridges, but not nearly enough to take full advantage of the system. The company has announced a "Super Expander" cartridge which enhances the supplied version of BASIC—adding color, sound, and hi-res graphics commands—and contributes another 3K of memory. While this 7K still is not enough memory to support complex programs written in BASIC, it's an improvement.

One note about the VIC's memory. Commodore is touting the machine as being furnished with 5K of memory, and technically, it is. But 1K of this is devoted to the VIC's special character set. Though a bit misleading, this is ultimately good since it allows the user to change on-screen characters. Using a specially-written program, for instance, you can customize the VIC characters to Japanese, Greek, or Russian, to musical notation, or even create special game symbols.

Potentially, the VIC's graphics scheme looks good. Hi-res graphics are plotted on a 176-by-176-point screen and a fine selection of mosaic-graphics symbols are available. Each of these characters, again, can be customized. Alphanumeric characters, graphic symbols, and hi-res points can be any of eight colors, and all eight can be used at once. There are 16 screen colors and eight additional border colors. Designating character colors is done from the keyboard, and is simple.

Though the screen display is limited—23 lines of 22 characters each—Commodore plans to introduce a word processing program on a ROM cartridge for the VIC as well as adaptations of arcade games like "Galaxian," "Space Invaders," "Rally-X," and "Sargon," the award-winning computer chess program. Commodore says its program cartridges will cost \$20 to \$40. Controllers for these games—paddles and Atari-like joysticks—plug directly into the VIC, as do a light pen for "touch"-screen responses and a modem. VIC also has a "user port" so hobbyists can experiment with computer control of other electronic projects, and a special connector for a disk drive (again, costing more than the computer) and printer. Using three tone generators and a "noise" circuit, the VIC can play music and imitate almost any electronic-game sound. Programming these can be tricky, though.

VIC's excellent version of BASIC is essentially the same as the one used by its big brother, the Commodore PET. As a result, some PET programs should work on the VIC with only minimal changes. The keyboard, probably the best of all the home computers, is easy to use.

Though the VIC's \$299 pricetag sounds too good to be true, be aware of additional charges. A special Commodore cassette recorder is a necessity and costs \$75. The Super Expander cartridge (no price set) will be just as important. As with any computer, buy the VIC at a computer store (though they'll be on sale at department stores and hi-fi/video shops), and meet the local PET User Group for help from more seasoned computer veterans. If program development for VIC follows the pattern set by PET, VIC will have an international following with user programs contributed by owners around the world.

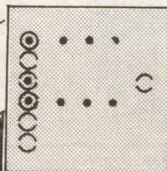
The least capable entry among the home computers, the Sinclair, is included here because of its low price and unique design. At \$200 (less discounted or as a kit) it may be a good starter for the budget-conscious. At first glance the ZX-80 doesn't look like much, or even look like a computer. It's smaller than this page and its plastic case makes it look somewhat like a child's toy. But it is a computer, albeit a limited one—not by size, but by design.

The computer comes in two models, one with 1K of memory and one with 2K. ZX-80 users claim this isn't as much of a

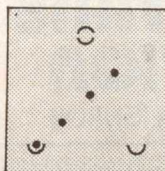
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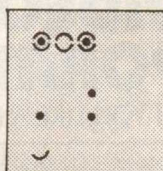
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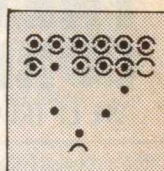
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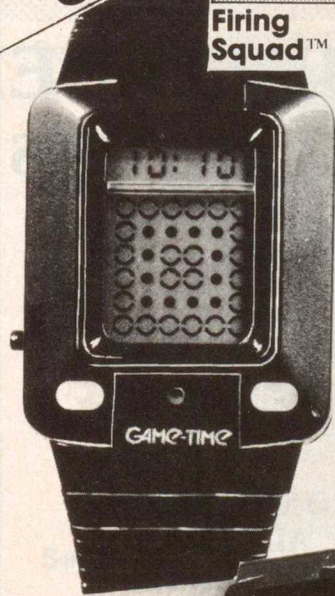
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problem as it seems because the version of BASIC it uses takes full advantage of these memory limitations by storing programs and data in a special way. (A 16K expansion module is available.) Still, memory is the fuel for a computing engine, so don't expect to do complex computing on this machine.

The most unique feature of the ZX-80's BASIC is the ability to enter individual commands—LOAD, LIST, NEW, RUN, PRINT—with only one key instead of typing the entire word. This can be good for the first-time programmer, but a bit bothersome if you're accustomed to any other system. Since the ZX-80 is not a color graphics computer, graphics aren't as important as on other machines. Graphic games are practically impossible with this machine because its tiny memory is used for both the screen display and program storage. Furthermore, the internal microprocessor does both the computing and the video chores, and a smoothly moving display screen is an impossibility. The ZX-80 comes with all the interconnecting cables necessary to attach the computer to your TV set and any audio-tape cassette recorder. No disk drives or printers are available. Sinclair apparently sells prerecorded program cassettes in Britain where the computer comes from but you'll be on your own with this one for the most part.

So why mention the ZX-80 at all? Well, some people buy computers and then decide they either can't use or program them. With the low investment the ZX-80 requires, you can change your mind knowing you haven't invested thousands in a system. Besides, the computer is so unique that you may have a tough time convincing friends it's a real computer.

Sinclair products aren't widely distributed in the United States, so the ZX-80 may be difficult to find. A kit version called the MicroAce is sold by mail via ads in computer magazines, and a newer model, the ZX-81, has already been introduced in Britain.

The Atari 400

Atari recently dropped its computer systems' prices, and the Atari 400, priced at \$399, is now one of the most capable "under-\$500" home computers. The company's other computer, the model 800, is aimed at the advanced personal, professional, and business markets, while the 400 is for hobbyists. Though significantly cheaper than the 800, the Atari 400 is comparable in its computing power.

Almost any program designed to run on the more expensive 800 model will run on the 400 if the machine is equipped with enough memory. But Atari intends the 400 to be a 16K machine and only furnishes it in that memory size. Other manufacturers offer upgrading hardware that boosts the 400's memory to 32K or even 48K, but Atari's warranty is voided by their installation. Still, many Atari owners are

upgrading their 400s as an alternative to much higher-priced systems.

Like the VIC and Radio Shack Color Computers, the 400's \$399 cost can be deceptive. At this price you buy *only* the computer. The necessary cassette recorder is another \$80 and a ROM BASIC cartridge is \$60. A floppy-disk drive is available for \$600. Unfortunately, most other accessories such as modems and printers require Atari's Interface Module.

After investing in the \$399 computer, you can get program and equipment packages to customize the systems for your own uses. If you want to program in BASIC, you can buy either the Programmer package (BASIC cartridge and manuals, \$70) or the Educator (BASIC, recor-

der, and programs, \$145). If you want to turn the 400 into a computer terminal, buy the Communicator package (modem, interface module, and program cartridge, \$400). If you just want the machine to be a super game system there's the Entertainer, which includes Atari's infamous "Missile Command" game cartridge, a truly remarkable game called "Star Raiders," and a pair of joysticks for \$90.

It isn't surprising, given Atari's expertise in designing video games, that the most attractive feature of these computers is their graphics. Atari computers offer no fewer than nine different graphics modes ranging from alphanumerics and mosaic graphics to hi-res four-color graphics (up

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to 160 by 96 points) and super hi-res graphics. But this versatility makes designing graphics a challenging, complex task requiring long hours of brainwork. To make things simpler Atari has published several excellent reference guides and is even holding inexpensively priced seminars across the country to help programmers. The 400 can also produce sounds, music, and noise. Each of its four audio generators can squawk a pure tone or electronic raspberry.

Independent programmers have begun to write and sell programs, but Atari still makes the best. "Scram," a \$20 tape cassette, is a colorful nuclear power plant simulation. Adaptations of arcade games including "Asteroids" are about

\$40 for a ROM cartridge. If you buy a disk drive, you can use Atari's financial packages and word processor. Visi-Calc is also available. The Atari 400 has a familiar design defect, however—its flat, keyless "touch" keyboard. Though its layout is like that of a conventional typewriter, pieces of plastic make holes that separate each key. Again, touch-typing is difficult if not impossible.

The Present vs. the Future

Will computer prices come down? Of course they will, but the drop may not be as sharp or as quick as consumers hope. The cost of computers has already dropped since the introduction of the first machines more than five years ago. Then,

the introduction of home computers priced at under \$500 was thought to be impossible. It now takes fewer parts to make a computer, hence the lower prices. In any case, the next decade will see cheap, powerful machines that will make most of today's computers look like Model Ts.

If you're interested in computers, though, don't think about waiting for either lower prices or amazing new machines. Understanding computers is becoming more important by the day, and the fun these machines offer can't ever be measured in dollars or sense.



War Films

continued from page 66

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the inevitable military victory.) Robert Ryan is an executive officer around whom Wayne is promoted directly to C.O. Ryan, mindful that someone up there doesn't like him and constantly trying to prove his competence to Wayne, goes through two campaigns with Wayne before a final air battle shows him taking responsibility and coming through like a hero. Ray's relentless emotional style throws our sympathy to Ryan, and when he's given a victory in the eyes of the hard-fisted Wayne we're as relieved as when the war in the skies is won.

Sands of Iwo Jima and *Flying Leathernecks* abound in thrillingly authentic action sequences which come across well on the home screen. The black-and-white photography in *Iwo Jima* helps Dwan seamlessly integrate authentic footage from Pacific skirmishes, and *Leathernecks* takes to the skies with glorious abandon, thanks largely to the enthusiasm of producer Howard Hughes. Technicolor also adds vividness to the airborne sequences; this is the most impressive-looking color film about the war until *Patton* comes along.

Peck vs. Battle Fatigue

Twelve O'Clock High, a tense and dramatic portrait of another military disciplinarian, embodies the same conflict and visual excitement. Gregory Peck, in one of the best performances of his career, plays an Army Air Command leader who's put in charge of European low-altitude aerial bombing missions over Germany. Stationed in England to command an air station over which the previous, well-liked commander (Gary Merrill) exercised lax leadership, Peck prods his men into shape and learns in the process that steely determination and military professionalism isn't always enough to get one through a war. In a prolonged air attack, Peck sees his men die and their planes pirouette to the ground; when time comes for the next raid, Peck can't climb into his plane. He goes into shock as his